

Attorney Docket No.: 205551-0002**AMENDMENTS TO THE CLAIMS:**

Please AMEND the claims as indicated below:

1. (Withdrawn) A reverse spreading device for reversely spreading complex base band signal, one being composed of an I (In-phase signal) component and another being composed of a Q (Quadrature phase signal) component and each being spread using spread codes of n-pieces of chips for one symbol signal comprising:

a first correlator having first delay devices whose number is an integral multiple of n-1 and which sequentially shift said base band signal composed of said I component by delaying it at a predetermined time interval, having n-pieces of first multipliers each performing a multiplication between said base band signal composed of said I component shifted by said first delay devices and a spread code and having m-pieces of first adders each performing integration of an output from k-pieces of said first multipliers out of n-pieces of said first multipliers and outputting the result of said integration as an intermediate signal composed of said I component ($m=n/k$);

a second correlator having second delay devices whose number is the same as that of chips for one symbol signal sequentially shifted by delaying said base band signal composed of said Q component at a predetermined time interval, having n-pieces of second multipliers each performing a multiplication between said base band signal composed of said I component sequentially shifted by said second delay devices and said spread code and having m-pieces of second adders each performing integration of an output from k-pieces of said first multipliers out of n-pieces of said first multipliers and outputting the result of said integration as an intermediate signal composed of said Q component;

m-pieces of phase rotators each performing a rotation correction by phase-rotating m-pieces of said intermediate signals each being composed of said I component produced by each of said first correlators and m-pairs of complex intermediate signals containing m-pieces of intermediate signals composed of said Q component produced by said each of said second correlators, on a complex plane at a phase rotation angle at m-stages each being slid by a reference rotation angle for every pair of said complex intermediate signals;

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a first adder to perform calculation of a correlation value composed of said I component by doing integration of said I component of said m-pieces of said complex intermediate signals obtained after said rotation correction is made by each of said phase rotators; and

a second adder to perform calculation of a correlation value composed of said Q component by doing integration of said Q component of said m-pieces of said complex intermediate signals obtained after said rotation correction of each of said phase rotators is made.

2. (Withdrawn) A reverse spreading device for reversely spreading complex base band signals, one being composed of an I (In-phase signal) component and another being composed of a Q (Quadrature phase signal) component and each being spread using spread codes of n-pieces of chips for one symbol signal comprising:

a first multiplier to sequentially perform a multiplication between base band signals composed of said I component and said spread codes of n-pieces of chips;

a first correlator to produce m-pieces of intermediate signals composed of said I component by sequentially integrating said multiplied value obtained by said first multiplier for every k-pieces and by using said multiplied value as said intermediate signal and to output them as ($m=n/k$);

a second multiplier to sequentially perform a multiplication between said base band signals composed of said Q component and said spread codes of n-pieces of chips;

a second correlator to produce m-pieces of intermediate signals composed of said Q component by sequentially integrating said multiplied value obtained by said first multiplier for every k-pieces multiplied values and by using said multiplied value as said intermediate signals and to output them;

a phase rotator to perform a rotation correction by phase-rotating m-pieces of complex intermediate signals containing said intermediate signal composed of said I component and said intermediate signal each composed of said Q component on a complex plane at a phase rotation angle at m-stages each being slid by a reference rotation angle for every pair of said complex intermediate signals;

a first adder to perform calculation of a correlation value composed of said I component by doing integration of said I component of said m-pieces of said complex intermediate signal obtained after said rotation correction by each of said phase rotators is made; and

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a second adder to perform calculation of a correlation value composed of said Q component by doing integration of said Q component of said m-pieces of said complex intermediate signals obtained after said rotation correction by each of said phase rotators is made.

3. (Currently Amended) A reverse spreading device for reversely spreading a complex base band signals, ~~comprising one base band signal being composed of which was spread using spread codes, and includes an I (in-phase signal (I) component and another base band signal being composed of a Q (Quadrature phase signal (Q) component that each include amplitude information, and each base band signal being spread using spread codes of n-pieces of chips for one symbol signal~~ the device comprising:

a frequency error correcting device configured to receive the complex base band signal, count how many a number of chips of said the complex base band signals to be inputted, and to perform a rotation correction in a step-by-step manner by rotating sequentially rotate a phase of said the complex base band signals on a complex plane by at a step number multiple of a phase angle, wherein the phase angle equals phase rotation angle at m stages each being slid by a reference rotation angle being an angle obtained by dividing a rotation angle (2π) of a revolution to divided by M portions, every time when a count of the number of chips increases by K[[chips]] to produce a rotation corrected complex base band signal, wherein the frequency error correcting device maintains the amplitude information of the I and Q components of the complex base band signal in the rotation corrected complex base band signal;

a spread code multiplier configured to receive multiply each of the rotation corrected complex base band signals, and multiply the rotation corrected complex base band signal obtained after the rotation correction by said frequency error correcting device is made, by said the spread codes to produce a plurality of multiplied values; and

two a plurality of accumulative adders configured to receive the plurality of multiplied values, and produce a correlation value composed of said I component and a correlation value composed of said Q component by performing accumulative addition of the multiplied values from said spread code multiplier for one over a symbol period for each of said the I component and the Q component to produce a correlation value for the I component and a correlation value for the Q component, respectively.

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4. (Currently Amended) The reverse spreading device ~~according to~~ Claim 3, wherein ~~said the~~ frequency error correcting device ~~is composed of~~ comprises:

a chip number counter configured to sequentially count how many the number of chips of ~~said the~~ complex base band signal, ~~to be inputted and to provide an instruction for incrementing every time when count~~ the number of chips increases by K ~~[-1]~~ chips; ~~of~~

a step number counter configured to receive the instruction for incrementing, and according to the instruction for incrementing, to increase said the step number by one if the ~~outputted~~ step number is equals a number other than $M-1$, and ~~to return said the~~ step number to 0 if ~~the~~ said step number is equals $M-1$ ~~in accordance with said instruction for incrementing fed from said chip number counter; and of~~

a phase rotator configured to perform a rotation correction by sequentially rotating ~~rotate~~ a ~~the~~ phase of ~~said the~~ complex base band signals ~~at by the step number multiple of the a phase rotation angle corresponding to a step number fed from said step number counter, out of phase rotation angles at M stages slid by said reference rotation angle.~~

5. (Withdrawn) The timing detecting device comprising said reverse spreading device claimed in Claim 1 and a peak detecting circuit to detect spreading timing based on sizes of correlation values of said I component and said Q component obtained by said reverse spreading in said reverse spreading device.

6. (Withdrawn) The channel estimating device comprising said reverse spreading device claimed in Claim 1 and a rotation correcting circuit to detect a phase error contained in a complex symbol obtained by said reverse spreading device and to perform correction of said phase error.

7. (Withdrawn) The timing detecting device comprising said reverse spreading device claimed in Claim 2 and a peak detecting circuit to detect spreading timing based on sizes of correlation values of said I component and said Q component obtained by said reverse spreading in said reverse spreading device.

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8. (Withdrawn) The channel estimating device comprising said reverse spreading device claimed in Claim 2 and a rotation correcting circuit to detect a phase error contained in a complex symbol obtained by said reverse spreading device and to perform correction of said phase error.

9. (Currently Amended) A timing detecting device, comprising:
~~said the~~ reverse spreading device ~~claimed in of~~ Claim 3; and
a peak detecting circuit configured to receive the correlation value of the I component and the correlation value of the Q component, and detect spreading timing ~~based on as a function of sizes of the correlation values of said the I and Q components and said Q component obtained by said reverse spreading in said reverse spreading device.~~

10. (Currently Amended) A channel estimating device, comprising:
~~said the~~ reverse spreading device ~~claimed in of~~ Claim 3 further configured to obtain a complex symbol; and
a rotation correcting circuit configured to receive the complex symbol, detect a phase error contained in ~~a the~~ complex symbol, ~~obtained by said reverse spreading device and to~~ perform correction of ~~said the~~ phase error.

11. (Withdrawn) A method for measuring a frequency error being a difference between a reference frequency of a receiver and a reference frequency of a sender comprising steps of:

shifting sequentially a base band signal composed of an I (In-phase signal) component and a base band signal composed of a Q (Quadrature phase signal) component and performing a multiplication between said shifted said base band signals each being composed of said I component or said Q component;

performing integration of k-pieces of multiplied values out of n-pieces of multiplied values obtained and producing m-pieces of intermediate signals composed of an I component ($m=n/k$);

performing a rotation correction by rotating phases of m-pairs of complex intermediate signals including m-pieces of intermediate signals composed of said I component and m-pieces

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of intermediate signals composed of said Q component at a phase rotation angle at m-stages each being slid by a reference rotation angle for every one pair of complex intermediate signals;

calculating a correlation value of said I component and a correlation value of said Q component by integrating said I component and said Q component of said m-pieces of said complex intermediate signals obtained after said rotation correction is made; and

calculating a power value of a complex symbol based on said correlation values of said I component and said Q component and selecting said reference rotation angle so that said power value becomes maximum and then detecting said frequency error based on said reference rotation angle selected.

12. (Withdrawn) A method for measuring a frequency error being a difference between a reference frequency of a receiver and a reference frequency of a sender comprising steps of:

performing a multiplication between base band signals, one being composed of an I component of n-pieces of chips and another being composed of a Q component of n-pieces of chips and spread code of n-pieces of chips and producing m-pieces of intermediate signals, one being composed of said I component and said Q component by integrating a multiplied value for every k-pieces of said multiplied value and to use an integrated value as an intermediate signal ($m=n/k$);

performing a rotation correction by rotating phases of m-pairs of complex intermediate signals including m-pieces of intermediate signals composed of said I component and m-pieces of intermediate signals composed of said Q component at a phase rotation angle at m-stages each being slid by a reference rotation angle for every one pair of complex intermediate signals;

calculating a correlation value of said I component and a correlation value of said Q component by integrating said I component and said Q component of said m-pieces of said complex intermediate signals obtained after said rotation correction is made; and

calculating a power value of a complex symbol based on said correlation values of said I component and said Q component and selecting said reference rotation angle so that said power value becomes maximum and then detecting said frequency error based on said reference rotation angle selected.

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13. (Currently Amended) A method for measuring a frequency error, being which includes a difference between a reference frequency of a receiver and a reference frequency of a sender, in a complex base band signal that includes I and Q signal components, a complex symbol, and was spread using spread codes, the method comprising the steps of:

counting how many the number of chips of the complex base band signals are to be inputted;

performing a rotation correction in a step-by-step manner by sequentially rotating a phase of said the complex base band signal on a complex plane by a step number multiple of a phase angle, wherein the phase angle equals at a phase rotation angle at m stages each being slid by a reference rotation angle being an angle obtained by dividing a rotation angle (2π) of a revolution to divided by M portions, every time said when the counted number of the chips increases by K[[-chips]] to produce a rotation corrected complex base band signal, wherein an amplitude information of the complex base band signal is maintained in the rotation corrected complex base band signal;

multiplying the rotation corrected complex base band signals by the spread signals codes obtained after the rotation correction is made to produce a plurality of multiplied values by said frequency error correcting device;

producing a correlation value of the I component and a correlation value of the Q component by adding the plurality of multiplied values fed from said spread code multiplier in an accumulative manner over a symbol period for every the I component and every the Q component during one symbol period;

calculating a power value of the complex symbol based on the correlation values of said the I component and said the Q component; and

selecting said the reference step number multiple of the rotation phase angle so that the for which the power value becomes is maximum; and

then detecting said frequency error based on the step number multiple for which the power value is maximum said reference rotation angle selected.

14. (Withdrawn) An AFC (Automatic Frequency Control) method to control a frequency of a reference frequency signal of a mobile station so that a frequency error measured by said frequency error measuring method claimed in claim 11.

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15. (Withdrawn) An AFC (Automatic Frequency Control) method to control a frequency of a reference frequency signal of a mobile station so that a frequency error measured by said frequency error measuring method claimed in claim 12.

16. (Currently Amended) A method ~~in accordance with claim 13~~ for AFC ~~(Automatic Frequency Control)~~ of a reference signal of a mobile station, comprising:

performing the method for measuring a frequency error of Claim 13; and further
~~comprising the step of:~~

~~controlling the a frequency of a the reference frequency signal of the mobile station so~~
~~that the frequency error detected in the calculating step is reduced.~~